Space Weather Technical Forecast

Issued on Thursday, 19 May 2022 at 01:05 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: R1-R2 Radio Blackouts likely.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate over the past 24 hours with frequent C-class flares, and a recent M1 flare from AR3014 at 18/2202 UTC.

There are currently seven numbered sunspot regions on the visible disc. AR3014 (Ekc/Beta-Gamma-Delta) has continued to grow in overall size, albeit relatively slowly, with the areal extent of its trailing penumbra increasing. The large trailer spot maintains a clear delta configuration, with the slightly smaller lead spot also showing a weak delta configuration. Other spot regions are much smaller and less magnetically complex, and generally either stable or showing decay.

No Earth-directed CMEs have been observed in the last 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by ACE and DSCOVR at L1 was indicative of a waning coronal hole fast wind from CH81. Wind speeds declined from 550km/s to near 450km/s. The density has been mainly average or below average. The Interplanetary Magnetic Field, Bt, was mainly weak 3-6nT. The north-south component, Bz, fluctuated weakly. The phi angle was predominantly positive (away from the Sun), with some recent short periods of negative (toward the Sun) orientation. Geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) has been at Background levels through the last 24 hours. The high energy electron flux (greater than 2 MeV) has remained mostly at background levels, with the corresponding electron fluence well below the Active (1e8 integrated pfu) threshold on gentle rising trend. Observed fluence at 19/0000 UTC was 2.21e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to continue mostly Low, but with further Moderate-class flares likely, and a slight chance of an isolated Strong-class flare (R3 Radio Blackout).The main source of activity is expected to be AR3014 which continues to grow and is a large region just east of the north central disc.

Solar Wind / Geomagnetic Activity: A weak CME was observed which could have originated from AR3015 at 17/0510 UTC. This has been assessed as most likely passing behind Earth's orbit on 20 May, but may give a glancing blow but with very low confidence. Slightly elevated to elevated solar winds are expected to persist through much of the period, as further coronal hole influence is anticipated from CH82.

Geomagnetic activity is forecast to increase to Unsettled to Active with a slight chance of a G1/Minor Storm interval, due to the fast wind arrival of CH82, most likely on day 1 (19th).

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Thereafter, largely Quiet to Unsettled conditions, with a slight chance of Active intervals.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to be at background levels during this period, but with a slight chance of flux reaching above S1, should any notable flares occur, primarily from AR3014. The high energy electron flux (greater than 2 MeV) is forecast to remain at background levels at first, but may rise over the next few days, with an increased chance of the diurnal peak reaching High levels later in the period due to fast wind effects. The 24-hour electron fluence is expected to remain below the Active (1e8 integrated pfu) threshold during the forecast period, but with a likely rising trend.

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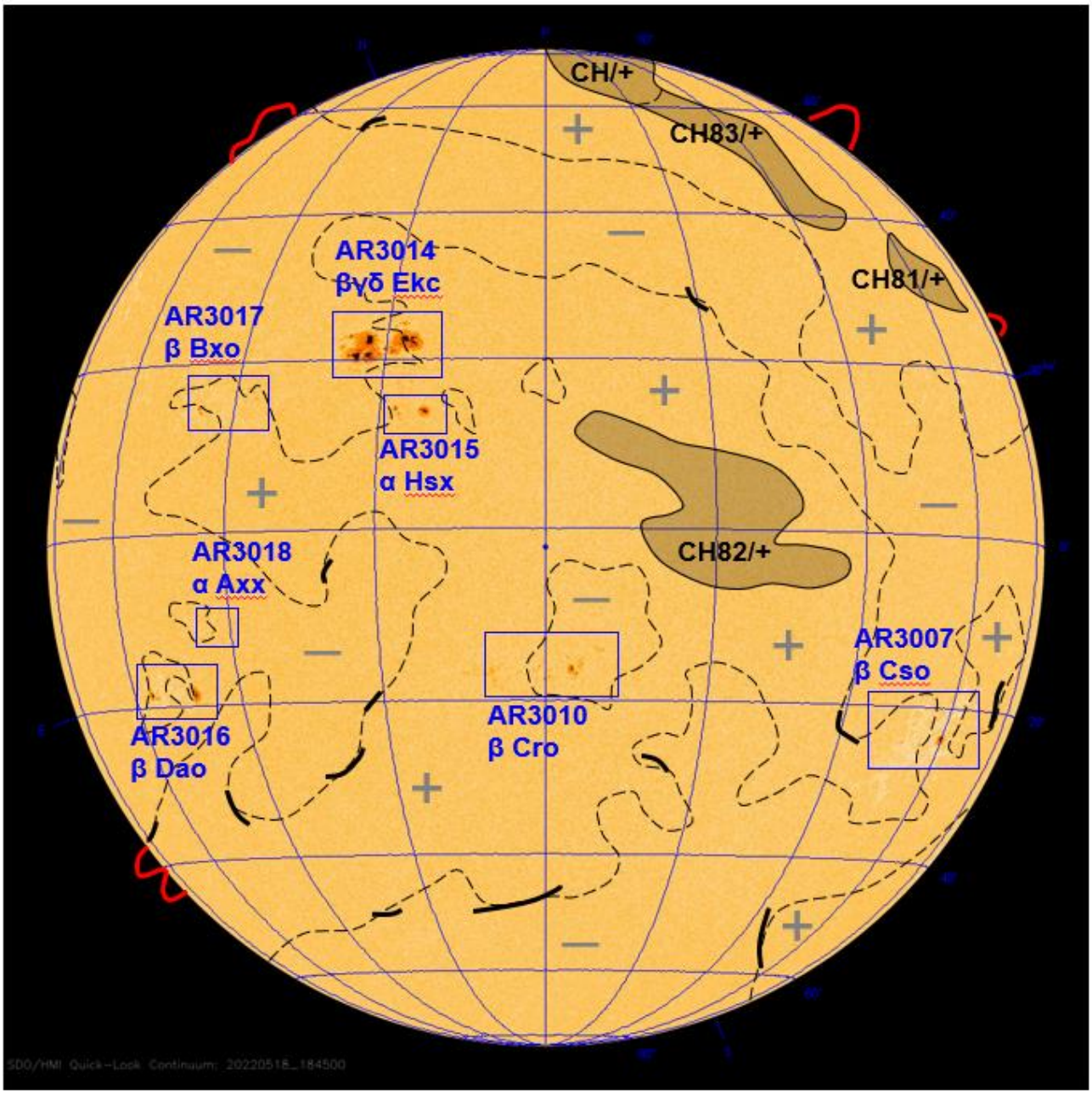
Figure 1. Solar Analysis Valid 18/1900 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

A weak CME observed in coronagraph imagery during 17 May could have originated from AR3015 at 17/0510 UTC. This has been assessed as most likely passing behind Earth's orbit on 20 May, however the assessment of the CME was difficult and confidence is very low. As such, there is just a very slight chance of a glancing blow from this feature on day 2 (20th), although this is unlikely to have a significant influence on the geomagnetic forecast.

Solar winds have eased erratically due to the waning influence of coronal hole 81. However, CH82 is expected to soon arrive, leading to slightly elevated to elevated winds persisting through much of the period. This is an equatorial hole, appearing stronger and significantly more westward extended than on the previous rotation, suggesting a more notable enhancement than observed 27 days ago.

Geomagnetic activity is forecast to increase to Unsettled to Active with a slight chance of a G1/Minor Storm interval, due to the fast wind arrival of CH82, most likely on day 1 (19th). Thereafter, largely Quiet to Unsettled conditions, with a slight chance of Active intervals.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	15	10	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

None expected.

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Met Office Space Weather Technical Forecast

Radio Blackouts - X-Ray Flares:

Solar activity has been Moderate over the past 24 hours with frequent C-class flares, and a recent M1 flare from AR3014 at 18/2202 UTC.

There are currently seven numbered sunspot regions on the visible disc. AR3014 (Ekc/Beta-Gamma-Delta) has continued to grow in overall size, albeit relatively slowly, with the areal extent of its trailing penumbra increasing. The large trailer spot maintains a clear delta configuration, with the slightly smaller lead spot also showing a weak delta configuration. Other spot regions are much smaller and less magnetically complex, and generally either stable or showing decay.

There are also two bright flux regions evident on STEREO A EUVI imagery which are close to the northeast and southeast limbs at present. These are likely indicative of further regions due to rotate onto the disc in the coming days.
Solar activity is expected to continue mostly Low, but with further Moderate-class flares likely, and a slight chance of an isolated Strong-class flare (R3 Radio Blackout).

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	60	60	60	60
Very Active	R3 to R5 X Class	No	15	15	15	15

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is at background levels and is expected to remain at that level through the period. However, there is a slight chance of an S1 or greater event during the forecast period. This is partly due to AR3007 as it transits towards the western limb of the visible disc, however the main risk is increasingly from AR3014. This large active region has seen its complexity increase during the last 24 hours, bringing an increased chance of M-class or greater flares.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	10	10	10	10
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2 MeV) as measured by GOES-16 at GEO is currently at background to moderate levels, but may rise over the next few days due to further coronal hole influences from CH82. This may give a chance of flux levels reaching High (1000 pfu) levels later in the period.

The corresponding electron fluence is expected to show an upward trend through the period, however on balance will most likely continue below the Active (1e8 integrated pfu) threshold. This is reflected by current REFM output, although this is currently trending too high on day 2 and 3 (20th and 21st).

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	5	10	30
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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